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## Impact testing Facility: BHISM for Performance based Design of Reinforced Concrete (RC) Structures

G. Jasawanth<sup>a</sup>, Suman Kumar<sup>b,\*</sup>, Hrishikesh Sharma<sup>a</sup>

<sup>a</sup>Indian Institute of Technology Guwahati, Kamrup, Guwahati and 781039, India

<sup>b</sup>National Institute of Technology Meghalaya, Bijnai Complex Laitumkhrah, Shillong and 793003, India

### Abstract

This research deals with the design and development of Blast and Heavy Impact Simulation mechanism (BHISM) for generating high fidelity data for impact resistant design, testing and validation of reinforced concrete structures experimentally. A commercial finite element software *LS-DYNA* is used to solve the governing equations, *Altair-Hypermesh* for meshing and *LS-Prepost* for pre and post processing. The basic principle used to generate high pressure shock wave is same as the shock tube. The propulsion of shock wave will achieve due to rupture of the diaphragm by accumulation of pressure in high pressure zone (driver section) of BHISM. A missile is placed after diaphragm i.e. low pressure zone (driven section) of BHISM. The Missile is restrained in five degrees of freedom except in the forward surge direction of translation. When the pressure is transferred on to the missile, it will move with a velocity. Analysing the RC members subjected to impact loading due to missile is future target. This research will be useful to find out the necessary parameters required for better construction of RC structures due to impact loading and to modify the existing codes on impact resistant RC structures.

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**Keywords:** BHISM; Shock Tube; Missile; Shock Wave; Velocity; LS-DYNA; Altair-HyperMesh; LS-PrePost.

### 1. Introduction

Nowadays purpose of civil engineering applications has been increasing due to desires of human kind. Due to the development in technology, need of infrastructure projects has increased rapidly. Reinforced concrete structures play major role and design of this structures due to application of different kinds of load combinations is necessary. Negative effects of non-linear dynamic loadings on reinforced concrete structures have been increasing such as earthquake, impact, blast loadings etc. Because of quick growth in infrastructure projects, high velocity collision of bodies has increased. This collision on vulnerable part of a structure might lead to the damage, and often, collapse of the structure.

*IMPACT* is an interaction phenomenon between a moving object and a structure, in which the kinetic energy of the object is suddenly transformed into energy of deformation and the consequent loading is *IMPACT LOADING*. This

\* Suman Kumar. Tel.: +91-708-591-2917 ; fax: +0-000-000-0000.

E-mail address: [sum92anith@gmail.com](mailto:sum92anith@gmail.com)

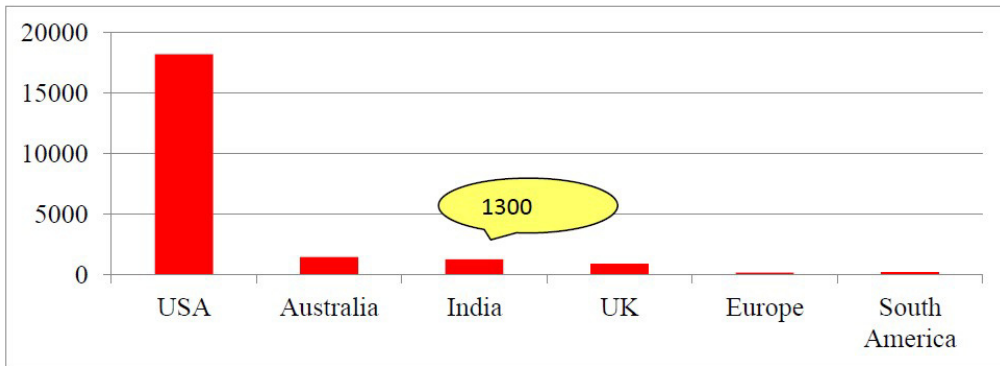


Fig. 1. Number of Impact and subsequent blast occurrence in some countries (1999-2005) [1]

is mainly due to the astray of missiles, aircraft, vehicle collisions, etc., as in terror attack. The significant increase of threat in the form of impact and blast due to terrorism is as shown in Fig. 1.

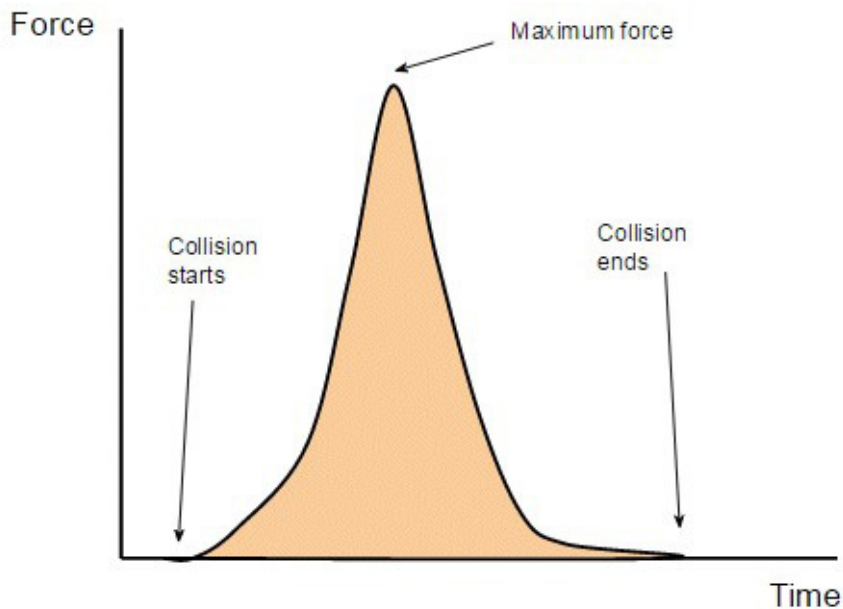


Fig. 2. Impact Loading, Force vs Time

Impact loading is kind of impulsive loading which is of short time duration with having high force (See Fig. 2). Inertia force developing due to this kind of loading is high. Design of RC members with existing codes due to impact loading is ineffective. Various analysis of impact loading on individual components of a RC structure can produce better results which is useful to improve the construction quality and consequently to serve the primary purpose of saving lives of people.

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